REMARKS

This response to the Office Action mailed on October 24, 2001 amends Claims 1, 10, 14, 17 and 18. Claims 1-23 of which claim 1, 14 and 17 are independent, are now pending in the application. Support for the above amendments can be found in the specification; on page 4, lines 20-25; on page 7, lines 4-8; on page 7, line 24 to page 8, line 5; on page 9, lines 21-25; on page 12, lines 8-14; on page 13, line 21 to page 14, line 14 of the specification; and throughout the remainder of the specification. Thus, no new matter is added.

The amendment to claim 10 resolves the Examiner's objection to the placement of the paragraph identifier.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned **"Version with markings to show changes made."**

Summary of an Illustrative Embodiment of the Present Invention

The illustrative embodiment provides a method and apparatus to address ink droplet placement problems associated with an inkjet printhead in an image forming system. The image forming system that practices the illustrative embodiment of the present invention discharges ink droplets from the printhead onto an imaging medium to create an image. Once the image is created, differences between a parameter of a first ink

droplet and a parameter of a second ink droplet are obtained through a measurement technique. The parametric measurement of the selected ink droplets in the image is then used by the image forming system to derive an ink droplet compensation value for each ink droplet.

Upon determination of an ink droplet compensation value, such as a velocity compensation value, the value is placed in a data file accessible to a processor associated with the image forming system. The processor utilizes the values in the data file to regulate, for example, to advance or retard, ink droplet discharge from the printhead of the image forming system to correct for ink droplet placement errors detected in the created image. Thus, the illustrative embodiment of the present invention provides a method and apparatus that compensates for the differences between the parameter of a first ink droplet and a parameter of a second ink droplet as measured following the creation of an image on an image medium.

Rejection of claims 1-8, 10, 12, 14, 16, 17 and 19-23 under 35 U.S.C. §102

The Examiner rejects claims 1-8, 10, 12, 14, 16, 17 and 19-23, as being anticipated by U.S. Patent Number 4,509,057 to Sohl et al. (hereinafter "Sohl"). In view of the following remarks and the above amendments, Applicant contends that claims 1-8, 10, 12, 14, 16, 17 and 19-23 are patentable over Sohl.

The cited Sohl patent relates to a method of calibrating a scanning carriage drop on demand inkjet ejector when the inkjet ejector moves past a droplet detection light

beam while droplets are ejected. *See* Figure 1 of Sohl. In particular, the method utilizes the apparatus as shown in Figure 1 to determine the velocity of a droplet ejection. The apparatus includes a light beam transmitted from an emitter optical fiber to a detector optical fiber to form a detection zone. An ejector controller activates an electromechanical transmitter at time T_0. The droplet is ejected from the exit orifice of the ink ejector in a direction R. When the droplet breaks the plane of the light beam in the detection zone, a detector output pulse is generated by the optical detector and provided to the ejector controller. The ejector controller measures the time between a drive pulse activation and the light beam interruption. Nowhere does Sohl teach or suggest measuring the difference between a parameter associated with first and second ink droplets as recited in amended claims 1, 14 and 17. Thus, Sohl fails to anticipate claims 1-8, 10, 12, 14, 16, 17 and 19-23.

The Examiner asserts that column 1, lines 42-49 and column 4, lines 30-40 of Sohl discloses measuring the difference between a parameter of a first ink droplet and a parameter of a second ink droplet. In fact, column 1, lines 42-49 of Sohl merely states that a method is provided calibrating an array of drop on-demand-ejectors and proceeds to define the type errors that can be corrected by the method. Furthermore, column 4, lines 30-40 of Sohl explains that an amplitude or a pulse width or both of a drive pulse can be increased or decreased to change droplet velocity. The above passages cited by the Examiner lack any explicit or suggestive power to teach or suggest the measuring or the determining of a difference between a parameter of a first ink droplet and a parameter of a second ink droplet once an image is formed. Consequently, the cited Sohl patent

fails to anticipate Applicant's invention of creating an image on an imaging medium, and determining from that image the difference between a parameter of a first ink droplet and a parameter of a second ink droplet.

Moreover, the Applicant's invention advantageously eliminates the need for a specialized apparatus, as disclosed in Sohl, to measure and correct for drop placement errors. Accordingly, Applicant's invention simplifies ink droplet alignment by avoiding the need to maintain optical alignment of the alignment device itself. As such, the Applicant requests reconsideration and withdrawal of the rejection of claims 1-8, 10, 12, 14, 16, 17 and 19-23 as being anticipated by Sohl.

Rejection of claims 1, 4, 7, 12-14, 17, 19, 22 and 23 under 35 U.S.C. §102(b)

The Examiner rejects claims 1, 4, 7, 12-14, 17, 19, 22 and 23, as being anticipated by U.S. Patent No. 4,626,867 to Furukawa et al. (hereinafter "Furukawa"). In view of the following remarks and the above amendments, Applicant contends that claims 1, 4, 7, 12-14, 17, 19, 22 and 23 are patentable over Furukawa.

The cited Furukawa patent relates to a method for preventing images from being unregistered due to positional deviation between the ink issuing from the ink nozzles of a print head with the respect to an intended direction of movement of the carriage. *See* Figure 2 of Furukawa. In particular, the method of Furukawa detects arrival of ink drops from the respective nozzles at a charge detection electrode. That is, the charge detection electrode is located in a fixed position where it will receive ink drops ejected by the head and charge by an electrode when the carriage assumes its home position. As Figure 2

illustrates, the charge detection electrode is in a fixed position and supported by a support frame that is coupled to the housing of the printer.

To detect arrival of ink drops ejected from the respective nozzles, the system drives the carriage to the left most position, as shown in Figure 2, and stops it there. Then, the controller turns on a deflection voltage source circuit and drives the carriage to the right, in Figure 2. During the movement of the carriage, the system counts pulses generated by a rotary encoder. As soon as a count is reached which represents a carriage position where ink issuing from one of the heads is moving toward an opening of the gutter, but short of the charge detection electrode, the system delivers a charge command to the print control unit. As a result, ink drops ejected from the head advance into the opening of the gutter. This process is repeated until the ink drops start impinging upon the charged detection electrode so that an output signal of a charged detection circuit changes its level to indicate a charged level. When this charged threshold is met, the system begins alignment of the next ink head with the charge detection electrode as described above.

In contrast, amended claims 1, 14 and 17 recite that a difference between a parameter of the first ink droplet and a parameter of the second ink droplet is determined or measured following the creation of the image. The Examiner relies upon column 2, lines 33-40 and lines 49-54 of Furukawa to teach or suggest the measurement of a parameter difference between droplets. However, claims 1,14 and 17 have been amended to clarify that the measurement or determination of a parameter difference between ink

droplets occurs after an image is created on an imaging medium, such as paper stock. Furukawa fails to create an image on an imaging medium when determining a difference between a parameter of a first ink droplet and a second ink droplet. Moreover, Furukawa utilizes a fixed detector to align an ink jet before creating an image on an imaging medium. Accordingly, Applicant's invention advantageously avoids the need to incorporate print head calibration hardware and circuitry into an image forming system for calibration of a print head. As a result, the image forming system of Applicant's invention is more compact, lighter, less expensive and easier to manufacture. Thus, Furukawa fails to anticipate claims 1, 4, 7, 12-14, 17, 19, 22 and 23. As such, Applicant respectfully requests reconsideration and withdrawal of the rejection of claims 1, 4, 7, 12-14, 17, 19, 22 and 23 in view of U.S. Patent No. 4,626,867 to Furukawa et al.

Rejection of claims 9, 15 and 18 under 35 U.S.C. §103(a)

In response to the rejection of claims 9, 15 and 18 under 35 U.S.C. §103(a) as being unpatentable over Sohl in view of U.S. Patent No. 5,576,744 of Niikura et al. (hereinafter "Niikura"). Applicant contends that these claims distinguish patentability over the cited art.

As discussed above, Sohl fails to anticipate amended claim 1 or amended claim 14 of the present invention. Accordingly, dependent claim 9 which depends, either directly or indirectly from amended claim 1, and dependent claims 15 and 18, which depend either directly or indirectly from amended claim 14 include the novel features of

amended independent claims 1 and 14. Accordingly, claims 9, 15 and 18 are also patently distinct from the cited Sohl patent.

Rejection of Claim 11 under 35 U.S.C. §103(a)

The Examiner rejects claim 11 under 35 U.S.C. §103(a) as being unpatentable over Sohl in view of U.S. Patent No. 4,847,638 of Moriyama (hereinafter "Moriyama"), Applicant contends that claim 11 distinguishes patentability over the cited art.

As discussed above, Sohl fails to anticipate amended claim 1 of the Applicant's invention. Accordingly, since claim 11 depends, either directly or indirectly, from amended claim 1, claim 11 includes the novel features of amended claim 1, and hence is patently distinct over the cited Sohl patent.

Conclusion

In view of the amendments and remarks set forth above, Applicant contends that claims 1-23 presently pending in this application, are patentable, and in condition for allowance. If there are any remaining issues, an opportunity for an interview is requested prior to the issuance of another Office Action.

Respectfully submitted,

LAHIVE & COCKFIELD, LLP

By: David R Burns
David R. Burns
Registration No. 46,590
Attorney for Applicant

28 State Street
Boston, MA 02109
(617) 227-7400
(617) 742-4214
Dated: December 6, 2001

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Please amend claims 1, 10, 14, 17 an 18 as follows:

1. (Amended) In an image forming system having an addressable printhead, a method for forming an image, the method comprising the steps of:

discharging at least first and second ink droplets from the printhead onto an imaging medium to create an image; and

measuring the difference between a parameter of the first ink droplet and a parameter of the second ink droplet following the creation of the image.

10. (Amended) The method of claim 1, further comprising the step of:

[(a)] adjusting at least one of

(a) a tilt position of the printhead;

(b) a direction of one of said first and second ink droplets; and

(c) a speed of one of said first and second ink droplets; based on said measured parameter difference

14. (Amended) In an image forming system, a method of forming an image with a printhead, the method comprising the steps of:

discharging a first set of ink droplets and a second set of ink droplets from the printhead onto a print medium to form an image;

determining differences in distance between the first set of ink droplets and the second set of ink droplets [when] once deposited on [a] the print medium; and

controlling [the] a subsequent discharge of the ink droplets from the printhead based on the differences in distance.

17. (Amended) An image forming system; comprising:

a printhead;

a processor for controlling the printhead; and

a printhead facility coupled to the processor for controlling the printhead based on differences between a parameter of a first ink droplet and a parameter of a second ink droplet [discharged from the printhead] measured after formation of an image on an imaging medium.

18. (Amended) The system of claim 17, wherein said differences between parameters further comprises an air gap distance between the printhead and [an] the imaging medium.